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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/843,661	04/26/2001	Jun Ishihara	15162/03540	9666

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EXAMINER	
QI, ZHI QIANG	

ART UNIT	PAPER NUMBER
2871	

DATE MAILED: 01/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/843,661	ISHIHARA ET AL.	
	Examiner	Art Unit	
	Mike Qi	2871	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 October 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 3-46* is/are pending in the application.

4a) Of the above claim(s) *6-46* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 3-5* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *6/2/03* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1 and 3-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 10-197827 (Yoshihiro) in view of US 6,118,586 (Tanabe et al).

Claim 1, Yoshihiro discloses (Abstract; paragraph 0042; Fig.3) that a polarization separation element (101) is constituted of a diffraction-grating substrate (102) and the diffraction-grating (102) is formed by an isotropic transparent substrate (i.e., a diffractive optical element layer formed out of an optically isotropic transparent sheet and having a diffraction grating surface); and an optically anisotropic birefringence layer (103) formed adjacent to the diffraction grating (102) (i.e., an optically anisotropic layer formed out of an optically anisotropic birefringent material and disposed continuously with the diffraction grating surface).

Yoshihiro doe not expressly disclose the diffractive optical element layer is made of a thermoplastic resin and is 0.1 to 1 mm thick.

However, Tanabe discloses (col.4, line 34 – col.5, line 56) that a transparent substrate made of plastic such as polycarbonate or polyolefin (thermoplastic material) having a thickness of about 1 mm. Because the diffractive optical element layer formed from an optically substantially isotropic transparent sheet, so that the material of the

transparent substrate also can be used for the diffractive optical element layer. As the common knowledge, the material of polycarbonate, polyolefin and acrylic resin are thermoplastic material having the property that repeatedly soften when heated and harden when cooled and easier molding.

Tanabe indicates (col.4, lines 54 – col.5, line 9) that such substrate on the optically anisotropic diffraction grating wherein an alignment film formed on the liquid crystal side of the substrate would have small damage during rubbing, and would reduce the production cost, and would improve the stability of the alignment of the liquid crystal. Even though Tanabe does not discuss the effect of the birefringence, but the same material would provide the same effect and would have the same performance.

Therefore, it would have been obvious to those skilled in the art at the time the invention was made to arrange 0.1 to 1 mm thick of a diffractive optical element layer and using thermoplastic resin material for the diffractive optical element layer as claimed in claim 1 for achieving small damage and stability of the alignment of the liquid crystal and minimizing the production cost.

Claim 3, Yoshihiro discloses (Figs.1-4; paragraph 0034, 0064) that the diffraction grating (11) has serrate microstructure periodically, i.e., a blazed grating, wherein the maximum height of the diffraction grating (11) H = 3.67 μm (i.e., $1.5 < H < 6$ μm), and all of the visible light would be sufficiently diffracted, therefore, having a sufficient diffraction efficiency for the visible light of a full wavelength band.

Yoshihiro does not expressly disclose the relationship of the refractive index.

However, Tanabe discloses (col.2, line 34 – col.4, line 20) that the refractive index of the optically isotropic material (np) is substantially equal to the ordinary refractive index (no) or extraordinary refractive index (ne) of the liquid crystal which functions as an optically anisotropic diffraction grating utilizing polarization of light (i.e., np $\approx$no; np $\approx$ne), and the Δn for isotropic material varies depending upon the temperature and satisfy $D\Delta n = \lambda_0/2$ (the D represents depth of the gratings that corresponding to the H for the height of the gratings) within a range 0 to 60°C, and then the go and return efficiency by diffraction becomes highest. The λ_0 is the wavelength in vacuum of the light from a light source, and that normally is about 600nm, and the H approximately is 3μm, so that the Δn would be $\lambda_0/2H$ (i.e., about 0.1; so that $0.1 < \Delta n < 0.3$).

Tanabe indicates (col.4, lines 6-20) that in order to optimize the temperature characteristic within 0 to 60°C, it is preferred to adjust the depth of the projection and the recesses (gratings) to satisfy the above relation at a temperature of at least 30°C, and the go/return efficiency by diffraction becomes highest.

Therefore, it would have been obvious to those skilled in the art at the time the invention was made to arrange the blazed grating as claimed in claim 3 for achieving a sufficient diffraction efficiency for the visible light of a full wavelength band and a highest diffraction.

Claim 4, the liquid crystal has birefringent characteristic, and functions as the optically anisotropic layer, and the liquid crystal layer using nematic or smetic liquid crystal that was a conventional in the art. Yoshihiro discloses (Figs.1-4) that a

polarization separation element wherein the optically anisotropic layer (103) is sandwiched between a transparent substrate (the optically anisotropic layer 103 must have a substrate to support the liquid crystal) and a diffractive element layer (102).

Concerning the orientation film, Tanabe discloses (col.3, line 55 – col.5, line 9; Figs. 4-5) an alignment film (24) is provided, and the rubbing direction for alignment and the direction of strips (gratings) are preferably adjusted to be the same (i.e., the molecules of the liquid crystal are orientated homogeneously along grooves of the diffraction grating surface), so as to improve the stability and reproducibility of the alignment of the liquid crystal and to prevent a deterioration of the alignment ratio due to the surrounding environment such as the temperature.

Therefore, it would have been obvious to those skilled in the art at the time the invention was made to arrange an alignment film as claimed in claim 4 for improving the stability and reproducibility of the alignment of the liquid crystal and preventing a deterioration of the alignment ratio due to the surrounding environment such as the temperature.

3. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yoshihiro and Tanabe as applied to claims 1-4 above, and further in view of US 6,102,545 (Ogino).

Claim 5, the transparent substrate and the diffractive optical element layer have substantially equal linear expansion coefficients that would have been at least obvious. Because the materials of the transparent substrate and the diffractive optical element layer having same linear expansion coefficients would have same expansion or

contraction when the environment temperature varies, and that would do not change the optical characteristics such as the light diffraction, etc., so as to improve the image display quality. As an evidence, Ogino discloses (col.30, lines 5 – 17) that a linear expansion coefficient difference between the substrate and the liquid crystal panel means would generate an expansion/contraction difference because of the temperature change, and the color tone becomes quite abnormal at the left and right ends of the screen, so that the substrate and the liquid crystal panel means having the same material, i.e., having the same linear expansion coefficients, would prevent the color tone change. That is the same principle as the transparent substrate and the diffractive optical element layer having same linear expansion coefficient so as to prevent any optical characteristics change, such that to improve image display quality.

Therefore, it would have been obvious to those skilled in the art at the time the invention was made to arrange the transparent substrate and the diffractive optical element layer having equal linear expansion coefficient as claimed in claim 5 for achieving a same expansion/contraction when the environment temperature changes so as to prevent any optical characteristics change and to improve image display quality.

Response to Arguments

4. Applicant's arguments filed on Oct.27, 2003 have been fully considered but they are not persuasive.

Applicant's **only** arguments are as follows:

1) The reference Tanabe does not include a diffraction grating surface, and there is no suggestion of any thickness of any thermoplastic substrate.

2) The cited references do not discuss the effect of thermoplastic substrate wherein the performance degradation of the separation device due to birefringence of the substrate is minimized.

3) The reference Ogino does not show or suggest a "diffractive optical element layer . . . having a diffraction grating surface . . . ".

Examiner's responses to applicant's **only** arguments are as follows:

1) The reference Tanabe is a secondary reference which discloses (col.4, line 34 – col.5, line 56) that a transparent substrate made of plastic such as polycarbonate or polyolefin (thermoplastic material) having a thickness of about 1 mm. Because the diffractive optical element layer formed from an optically substantially isotropic transparent sheet, so that the material of the transparent substrate also can be used for the diffractive optical element layer. As the common knowledge, the material of polycarbonate, polyolefin and acrylic resin are thermoplastic material having the property that repeatedly soften when heated and harden when cooled and easier molding.

2) Even though the secondary reference Tanabe does not discuss the effect of the birefringence, but the same material would provide the same effect and would have the same performance.

3) The reference Ogino is a secondary reference which discloses (col.30, lines 5 – 17) that a linear expansion coefficient difference between the substrate and the liquid

crystal panel means would generate an expansion/contraction difference because of the temperature change, and the color tone becomes quite abnormal at the left and right ends of the screen, so that the substrate and the liquid crystal panel means having the same material, i.e., having the same linear expansion coefficients, would prevent the color tone change. That is the same principle as the transparent substrate and the diffractive optical element layer having same linear expansion coefficient so as to prevent any optical characteristics change, such that to improve image display quality, and that is common and known in the art.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mike Qi whose telephone number is (703) 308-6213.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

ROBERT H. KIM
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800

Mike Qi
January 7, 2004